

Determinants of Technical Inefficiency of Saccos in Kenya: Total Revenue Output Slack Analysis

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ACKNOWLEDGEMENT: I thank Dr. Lucy Rono and Prof. Philip Nyangweso of Moi University(Kenya) for their unrelenting guidance and for giving advice towards this work.

Abstract

This study assessed the determinants of technical inefficiency of Saccos in Kenya. The explanatory research design was applied. The certified annual reports information was collected from a census total of 46 deposit taking Saccos and methods used in estimation of technical inefficiency were both non-parametric DEA and parametric SFA. The log truncated panel data covered a period of 8 years (2007-2014). The result indicates insignificant influence of all predictor variables on inefficiency given total revenue output (TR) slack as hypothesized in agency, x-inefficiency and intermediation theories. TR slack regression reflects a significant managerial influence as indicated by Gamma (0.999956). However, DEA result of all Saccos showed 0.024 mean inefficiency. The TR slack is key in identifying managerial inefficiency, thus apt for decision making while the relationship between earnings management and the insignificance of predictors given TR slack, should be explored in the future studies.

Keywords: Saccos in Kenya, Technical Inefficiency, Total Revenue Output Slack.

DOI: 10.7176/RJFA/11-8-05

Publication date: April 30th 2020

1. Introduction

This study seeks to find out the determinants of technical inefficiency given the total revenue slack (inefficiency) as a dependent variable over a period of two eras using both data envelopment analysis (a linear programming approach) and stochastic frontier analysis methods. Inefficiency occurs when a firm (or Sacco) operates outside the frontier of the production technology (Coelli, et al., 1997; Greene, 2012). However, according to Leibenstein, (1966) x-inefficiency is a foregone output due to management inefficiency, while efficiency is a subset of performance (Ozcan, 2008).

The co-operatives development regulation era in Kenya involved the enactment of prudential regulation of Saccos through the Saccos Act, 2008 which legally commenced in September 2009 and gave birth to Sacco Societies Regulatory Authority or SASRA with effect from October 2009 (SSA, 2008; MOCMD, 2013). Chiefly the pre-regulation era covered the period 2010 and before.

According to SASRA (2011) Saccos in Kenya total borrowings from banks in 2010 were estimated at Kshs.15 billion compared to Kshs. 5.6 billion in 2011. Thus the sector is a key financial channel in fostering access to credit.

On the international front, the Regulatory Authorities and Standards Setting Committees have been able to come up with acceptable information on the financial institutions' efficient operations and risk management criteria (Cooper et al., 2007). World Council of Credit Unions is one similar body that offers related services. Caprio et al., (2003) in their study in 44 countries, postulate that insignificant influence is experienced by banks

2. Literature Review and Background of the Study

This study adopted DEA (data envelopment analysis) approach which is linear programming oriented based on a capital rationing argument since the Saccos' external loan capital demand tends to fluctuate periodically (SASRA, 2011; Brealey and Myers,1981).

A star organization identification assists in identifying the managers' rewards and the kind of good practices employed or which can be copied by inefficient firms in the industry. Dexterity also aids in identifying profitable areas of organizations to invest their assets (Healy, 1988). The efficiency measurement system is able to identify optimum resource allocation besides setting targets.

The inefficiency measurement aids entities in the identification of best practice, identification of poor practice, in setting targets, in resource allocation and in monitoring efficiency changes periodically (Beasley, 1996). However, Barus et al. (2017) argue that the financial performance of Saccos in Kenya is not significantly affected by management efficiency.

A study by Johnson and Nino-Zarazua (2008) has shown that in Kenya 12.8% of the population save with Saccos and 4.1% borrow from them. In addition, Saccos in Kenya are principally either based on common bonds of farming or employment (Johnson and Nino-Zarazua, 2008). It is also worth noting that in Africa South of the Sahara, the Kenyan Saccos movement has the second largest number of Saccos following Ethiopia (Woccu, 2009). For instance, in March 2013, the number of Saccos in Tanzania were 5,559 (Magali, 2014) while in Kenya the total number of registered Saccos were estimated at about 7,500 in August 2013 (SASRA, 2013).

There are a few studies in the area of co-operatives since 1990 (Evans, 2002; Petrie, 2002; Emerson and Wiren, 2005). Further, these studies are basically based on absolute performance measures and interview responses from the stakeholders. The situation is slowly changing as other researchers are now coming up especially based on ratios, efficiency and multiple regression such as (Tsfamariam et al., 2013; Kivuwo and Olweny, 2014; Mirie, 2014; Marwa and Aziakpono, 2015).

The down turn in an economy increases the inefficiency of money-making enterprises than it does to co-operatives. Co-operatives have shown their ability to provide services to their members even during the financial crisis. However, in developing countries of Africa the co-operatives' resilience to the financial crisis is not strong and this coupled with the internal political impact or mismanagement within co-operatives means, the crisis gets worse (Wanyama et al., 2009). The number of women on the board predictor is picked as a variable although there is conflicting studies result in the effect of gender diversity on the boards. Adams and Ferreira (2008) argue that on average the presence of both genders on the boards in companies having no takeover prevention mechanism does experience inefficiency. On the contrary, Higgs (2003) postulates that performance improvement result from gender diversity in the board room while Gompers et al. (2003) conclude that gender is a good performance contributor in organizations with non-strong shareholder rights.

The latest liberalization of the co-operatives movement is in the area of devolution of co-operatives regulation from the national level to County levels as enshrined in the Constitution of Kenya 2010 (COK, 2010; MOCMD, 2013). These changes are aimed at the reduction of technical inefficiency. However, despite the existence of the prudential regulations, the deposit-taking Saccos have continued to reveal mixed levels of management inefficiency (SASRA, 2013). In addition, a study by Chavez, (2006) indicates that the Kenya Sacco sub-sector reflects a seriously weak financial performance position that is pervasive.

2.1. Theoretical Review

This research was guided by the theory of agency, x-inefficiency and the financial institutions' efficiency measurement theories; more precisely, the intermediation theory. Other discussed models relevant to this research are the financial institutions' prudential monitoring standards. However, the state agency of deposit-taking Saccos in Kenya advocates for the adoption of Camels Prudential Reporting Standards (Kivuwo and Olweny, 2014). In addition, this research used the BCC analysis based on inefficient results of DEA as dependent variables (Banker et al., 1984) which were used to identify the variables that best measure the pure technical inefficiency of the Saccos by running a truncated-normal regression given a census of 46 deposit taking Saccos that had attained the front office services activities (FOSA) operation requirements.

2.2. Statement of the Problem

The co-operatives sector in Kenya has gone through a historical development process known for inefficiency. The inefficiency was more prevalent during the liberalization period (Wanyama, 2009). As a result, the need for regulation and inefficiency understanding becomes necessary to ensure the stability of Saccos' sub-sector and guaranteed efficiency. This study is also an addition to the ongoing inefficiency of Saccos' research in the Kenyan context.

A few past researchers in Kenya have studied Saccos without utilizing SFA and identifying benchmark Saccos, they based on performance: (Olando et al., 2012; Karanja, 2013; Njagi et al., 2013; Nyambere, 2013; Okibo and Karagu, 2014; Barus et al., 2017). These studies ignored the aspect of inefficiency measurement. A more recent study by Mirie (2014) indicates Saccos' inefficiency in Kenya being within a range of 0.44 and 0.0. However, it failed to consider other specific variables of (in)efficiency measurement such as the economic indicators, gender diversity on Saccos' boards, and net profit to total assets ratio besides the extent of management influence on Saccos' inefficiency. Marwa and Aziakpono (2015) studied technical and scale efficiency of Saccos in Tanzania using DEA and concluded that on an average majority of Saccos scored 0.48 pure technical inefficiency and at least 75% of Saccos exhibited an increasing return to scale. A study by Kipeshu, (2012) arrived at the inefficiency of between 0.855 and 0.31 for the Tanzanian micro finance bodies. Similar researches in the banking industry in sub-Saharan Africa opine that technical inefficiency falls between 0.4 and 0.1 (Moffat, 2008; Kamau, 2011).

Tsfamariam et al. (2013) postulate that the efficiency of rural Saccos in Ethiopia indicated that efficiency is affected by both the location and size of Saccos. They also opine that on average inefficiency ranged between 0.787 and 0.741 for small Saccos, while larger Saccos recorded lower inefficiency compared to smaller ones. A

study like Magali (2014) in Kenya also suggested future studies in the area of Saccos' technical efficiency using the SFA.

Magali (2014) concludes that there is no prior studies on Saccos in East Africa that have assessed the influence of regulation on Sacco's performance while at the same time considering the impact of rural and urban areas' location of Saccos on performance. He further argues that scholars should extend to econometrics to expand Saccos modeling. A few studies such as Marwa and Aziakpono (2015) in Tanzania, and Tesfamariam et al. (2013) in Ethiopia, have researched on the efficiency of Saccos in the African continent.

Considering the above-mentioned gap of prior studies, this study examined whether Saccos were more inefficient during the regulation era than the pre-regulation era. The stars Saccos were also identified. Essentially this study assessed the determinants of the inefficiency of FOSA. Specifically, the pure technical efficiency (a cost-efficiency measure) model was utilized (Coelli et al., 1997).

The creation of SASRA as a regulator of Saccos has been necessitated by the challenges of a liberalized economy. The question that arises then is: to what extent has the Saccos' market become efficient? These facts then point to the need to measure and determine the Kenyan Saccos' pure technical inefficiency or efficiency. Pure technical efficiency occurs when a firm operates under variable returns to scale. This study sets deliberate standards on how Saccos in Kenya can be monitored and peers emulated to ensure efficiency in their operations.

2.3. The General Objective

The general objective of this study is to establish the determinants of technical inefficiency of deposit taking Saccos in Kenya, given total revenue slack (an output inefficiency) as a dependent variable.

2.4. The Specific Objectives

The specific objectives of this study are as follows:

1. Measure the extent of managerial inefficiency over the pre-regulation and regulation eras.
2. Establish the effect of macro-economic variables on the Saccos' total revenue output inefficiency.
3. Determine the effect of Saccos' specific predictor variables on Saccos' total revenue output inefficiency.

2.5. Research Hypotheses

The study also tests the hypotheses that:

1. H_{01} : The Saccos operation is not influenced by managerial influence (inefficiency) as measured over the two eras.
2. H_{02} : There is no strong relationship between the Saccos' macro-economic variables and total revenue output inefficiency dependent variable.
3. H_{03} : There is no strong relationship between the Saccos' specific independent variables and total revenue output inefficiency dependent variable.

2.6. The Concept of Technical Inefficiency

The conceptual framework model in figure I reflects the dependent variables derived from the output inefficiencies (specifically, the TR slack), and independent variables relationship. The frontier preliminary analysis involved determination of correlation between each of the Saccos' variance regressors and prime regressors, and if a high correlation is discovered, such specific independent variable (prime regressor) is removed from the second or final stage regression process. However, no variable was removed and this estimation was also internalized within the Stata 14.1. Further, prime regressors are also assumed to be measurement errors free (Cooper *et al.*, 2007).

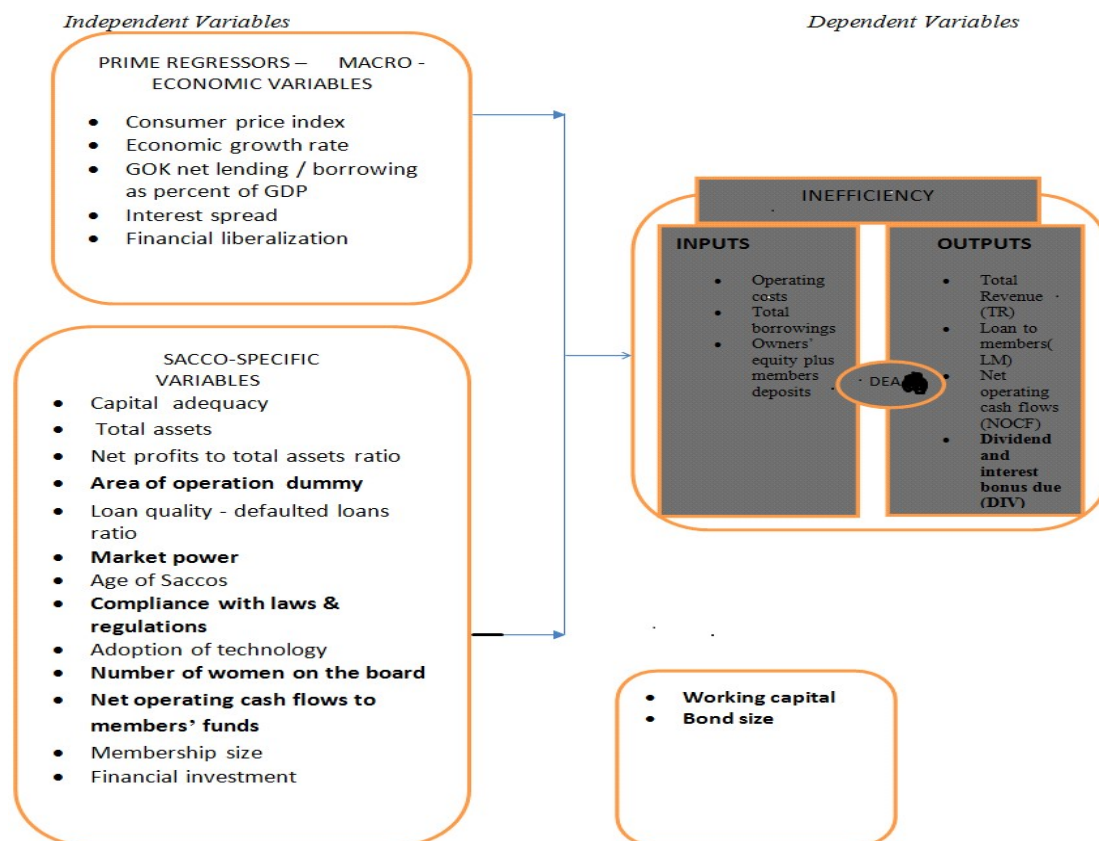


Figure-1. Conceptual Frame Work

Source: Researcher, (2015)

3. Research Methodology

3.1. Design

This explanatory study used a balanced panel data. The explanatory study research design was employed in soliciting for secondary information from the audited annual reports and websites of the regulators on determinants of Saccos' inefficiency in Kenya. This study utilized a second stage data envelopment analysis by subjecting the resultant data to SFA (stochastic frontier analysis). An econometric approach in estimation of Saccos' inefficiency determinants was utilized since SFA stipulates the functional form of cost or production frontier (Cummins and Zi, 1998). The panel data has benefit of assisting in studying the behavior of each Sacco on cross-sectional and time-series or year basis (Ongore and Kusa, 2013). Further, the study utilized a census technique whereby 46 licensed Saccos under the regulator's control within the two periods of study running from 2007 to 2010, and 2011 to 2014 (a span of 8 years) were selected.

3.2. Model Specification

The estimation of inefficiency was carried out utilizing the Cobb-Douglas cost frontier cross-sectional panel data of Saccos over two periods. Truncated-normal distribution was assumed Coelli *et al.* (2005) and Cooper *et al.* (2011). Stata 14.1 was used to decompose errors (Jondrow *et al.*, 1982; Pascoe *et al.*, 2003). The SFA was based

on Cobb-Douglas logarithmic model $\ln y_{ijt}^* = \beta_0 + \sum_{k=1}^K \beta_k \ln Z_{kijt} + V_{ijt} + U_{ijt}$ (1); where: β_r is the frontier deterministic component, V_{ijt} is stochastic part and U_{ijt} presents the shortfall observed individual fails to hit the optimum (frontier), j ($j=1, \dots, n$) is the cross-sectional identifier, t ($t=1, \dots, t$) is time identifier, y_{ijt}^* is the first stage optimal slack (normalized) in output r of DMU $_j$ (decision making unit j), β_0 is the intercept of output slack equation, 'ln' is natural logarithm, and Z has k ($k=1, \dots, k$) observable environmental factors (Battese and Coelli, 1995).

The specific forms of equation (1) estimated for research of determinants of technical inefficiency of Saccos is thus written as: $\ln(TR_{ijt}) = \beta_0 + \beta_1 \ln(age_{ijt}) + \beta_2 \ln(ca_{ijt}) + \beta_3 \ln(ta_{ijt}) + \beta_4 \ln(ao_{ijt}) + \beta_5 \ln(lp_{ijt}) + \beta_6 \ln(mp_{ijt}) + \beta_7 \ln(clr_{ijt}) + \beta_8 \ln(atech_{ijt}) + \beta_9 \ln(w_{ijt}) + \beta_{10} \ln(ncfma_{ijt}) + \beta_{11} \ln(ms_{ijt}) + \beta_{12} \ln(cpi_{ijt}) + \beta_{13} \ln(goklb_{ijt}) + \beta_{14} \ln(insp_{ijt}) + \beta_{15} \ln(flib_{ijt}) + \beta_{16} \ln(fi_{ijt}) + \beta_{17} \ln(npta_{ijt}) + \beta_{18} \ln(gdp_{ijt}) + \beta_{19} \ln(wc_{ijt}) + \beta_{20} \ln(bond_{ijt}) + V_{ijt} + U_{ijt}$

(2)

3.3. DEA Result

The study examined the inefficiency and efficiency census of 46 Saccos using a non-parametric variable return to scale (VRS) - BCC or technical inefficiency model. The model utilized was output oriented whereby the output included: total revenue, loans to members, net operating cash flows, and dividend plus interest on members' deposits while inputs were: operating costs, total borrowings and owners' equity plus members' deposits. The panel data model utilized using Stata DEA software was derived from 368 observations while technical inefficiency was measured on scale of 0 up to a maximum of 1. DEA result indicated that a total of 24 out of 46 Saccos were strongly efficient and exhibited zero slacks across all output variables and this was attributed to net operating cash flows reported for the corresponding years.

3.4. Output Description

Table I presents the mean output as expressed in TR (total revenue slack), LM (loan to members' slack), NOCF (net operating cash flows slack), and DIV (dividend slack) in Kshs.Million for years 2007 to 2014. As reflected in the table I the mean TR, LM, NOCF, DIV for the Saccos sub-sector (FOSA) was 427, 2234, 1038, and 148 respectively. The overall mean score as a percentage of the Saccos' sub-sector sum was 0.18% across all outputs.

Table-I. Eight Years Mean Outputs of Saccos in Kenya

Eight Years Average Outputs of Saccos in Kenya				
	TR	LM	NOCF	DIV
Mean score	427	2234	1038	148
Standard Deviation	1114	6720	1380	596
Mean as a % of Industry Sum	0.18	0.18	0.18	0.18
Observations	368	368	368	368

Source: Researcher, (2015)

3.5. Descriptive Statistics

The descriptive statistics in table II presents specific variables that determine the inefficiency of Saccos in Kenya. As reflected in the table II, the mean capital adequacy of Saccos in Kenya was 21%. The percentage is above 10% set by SASRA (SSR, 2010). This indicates that Saccos in Kenya running FOSA hold more capital than required. This was an indication that Saccos running FOSA in Kenya were risk averse and in return earn less profit. On the contrary the ratio of net profit to total assets is high at 22%, an indication of mixed result pointing to the direction of inefficiency or earnings management (Schilit,2002 and Brown, 2006). The market power of 2% is far below 70% standard market share that indicates a few firms being in control of an industry (Ogebe *et al.*, 2013). Further, the average women on the board stood at 20 % with standard deviation of 12%.This is a low number and has little influence on Saccos' inefficiency (Higgs, 2003).

The table II also reflect mean defaulted loans ratio being 3% which is below 4% according to census research on Saccos in Meru County Kenya (Olando *et al.*, 2012). This is an indication that the regulator role has played an impact in reducing the default risks to lower percentage and may point to the direction that in this sub-sector, loan guarantors carry next to 97% burden in case of any default thus lowering LP effect on inefficiency. According to Brown and O'Connor (1999) higher default rate lowers the relative efficiency of a money market. The average age of Saccos was shown as 27.07 years with a standard deviation of 9.3 years, a reflection of a young industry. Magali (2014) posit that age and size are correlated in the same direction and that a rise in age of a small firm has a positive relation with efficiency.

Table-I I. Descriptive Statistics of Predictor Variables

Descriptive Statistics of Predictor Variables										
Variables	CA	Bond	NPTA	MP	W	MS	LP	Age-Yrs.	GOKLB	
Mean	0.21	5.33	0.22	0.02	0.20	21245	0.03	27.07	2.72	
Standard Deviation	0.15	10.78	0.02	0.04	0.12	36063	0.09	9.30	1.37	
Observations	368	368	368	368	368	368	368	368	368	

Source: Researcher, (2015)

3.6. Operationalization of the Study Variables

The study measurements used to operationalize the study specific variables are as indicated in table III.

Table-I I I. Study Variables

Study Variable	Measurement
Capital adequacy(CA)	Core capital to total assets
Total assets(TA)	Total assets
NPTA	Net profit to total assets
Area of operation (AO)	Dummies 1-City ; 0 -Urban
Loan quality(LP)	Loans provision
Market power(MP)	Sacco deposit to total FOSA deposits
Age	Number of years in operation
CLR	Compliance with regulations(average scores)
Atech	Computerization expenditures
W	Fraction of women on the board
NCFM	Net operating cash flows to members funds
MS	Number of members
WC	Current assets less current liabilities
Bond	Size of contributing common bond employers
FI	Financial investments total amount

Source: Researcher, (2015)

3.7. Model Testing and Random Effects Estimation

The study test carried out to ensure that the data fits the linear regression assumptions include:

3.7.1. Normality Test

The study tested for normality using Shapiro-Francia W test as the observations were less than 5000 and greater than 10 under log normality condition (Stata, 2015). The result obtained is as shown in table IV which indicates that only two variables reflected p-values greater than 0.05 thus a possibility of heteroscedasticity. The data used also underwent natural logarithm transformation.

Table-IV. Testing Study Variables for Normality

	Shapiro-Francia	W test for normal data		
Variable	W'	V'	z	Prob. > z
Age	0.89443	29.112	7.251	0.00001
Ca	0.99163	2.307	1.798	0.03608
Ta	0.98818	3.259	2.541	0.00553
Npta	0.84112	43.814	8.13	0.00001
Ao	1	0	-58.997	1
Lp	0.74358	70.711	9.16	0.00001
Mp	0.93325	18.406	6.265	0.00001
Clr	0.70719	80.744	9.445	0.00001
Atech	0.68281	87.468	9.617	0.00001
W	0.98012	5.482	3.66	0.00013
Ncfma	0.34704	180.06	11.171	0.00001
Ms	0.99448	1.522	0.904	0.1831
Cpi	0.95686	11.896	5.326	0.00001
Gdp	0.61534	106.072	10.032	0.00001
Goklb	0.62312	103.927	9.988	0.00001
Insp	0.90277	26.813	7.074	0.00001
Flib	0.53518	128.178	10.439	0.00001
Wc	0.13271	239.162	11.781	0.00001
Bond	0.92325	21.164	6.565	0.00001
Fi	0.80534	53.678	8.567	0.00001

Source: Researcher, (2015)

3.7.2. Multicollinearity Test

The possibility of strong relationship between predictor variables was checked using the correlation Coefficient-Spearman rho. The result indicated a few scores of higher than or equal to 0.8, thus reflecting lack of serious multicollinearity among variables. Thus coefficients computed were considered reliable. A second non-observational method was utilized in testing for multicollinearity that is, variation inflation factor and the result for each dependent variable is as indicated in table V. This result indicates TR slack regressed against all

independent variables confirm lack of serious multicollinearity possibility for all predictors except GOKLB, CLR and TA. Studies have also indicated that a VIF above 20 is the one that should be categorized as challenging (Greene, 2012). GOKLB and CLR being above 20 are the only two most challenging thus ignored, given that the covariates VIF mean will not fall below 4 even on elimination of all the three challenging items. However, an average VIF of around 4 is not problematic (Stata, 2015).

Table-V. Dependent Variable-TR Slack and all Covariates VIF Results

Covariates	Variation Inflation Factor(VIF)
goklb	46.13
clr	26.38
ta	20.49
mp	17.87
gdp	10.02
cpi	10.01
age	8.73
flib	7.89
ao	7.18
w	5.57
insp	5.44
ms	5.36
ca	4.44
fi	3.64
ncfma	2.47
lp	2.03
bond	1.99
npta	1.91
atech	1.86
wc	1.73
Mean VIF	9.56

Source: Researcher, (2015)

3.7.3. Random Effects Estimation

The Hausman-Taylor estimator method was used to confirm that none of the covariates of the panel-level models are correlated with unobserved panel-level random effects (U_{ijt}), although some of the covariates may be associated with the unobserved individual-level random effect. The result of the estimation summary is as indicated in table VI. The result indicates that the unobserved random effect $\delta\mu = 0.9562$ greater than $\delta_{error} = .0932$, suggesting that large portion total error variance is as a result of U_{ijt} , idiosyncratic error. Therefore, the fixed effects model and random effects model in the panel data are different (H_1) and random effects model is preferred (that is, reject H_0). Meaning the ordinary least squares (OLS) would give inconsistent result (Stata, 2015).

Table-VI. Hausman Taylor Estimation –Slack TR and Covariates

Summary of Items	Result
Number of observations	54
Number of groups	23
Random effect	Urjt ~ iid
Wald chi sq.(20)	43.40
Prob.> chi sq	0.0018
Sigma U_{ijt}	0.9562
Sigma error(V_{ijt})	0.0932
R_{ho}^*	0.9906

Source: Researcher, (2015). * Fraction of value due to U_{ijt}

4. Spearman Correlation and other Key Findings

The results of the correlation indicated that the working capital or insolvency measure had weak negative correlation of -0.2739 with TR slack while women on the board at + 0.562. This correlation is not in compliance to a prior study which postulate that higher number of women on the board decreases inefficiency depending on the type of industry (Ferreira and Adams, 2009). Capital adequacy is also negatively correlated (-0.4108) to dependent variables of TR slack in line with the expectation of the agency, financial intermediation and efficiency theories (Famma, 1980; Magali and Pastory, 2013). The correlation also indicates that there is a negative

relationship between log of total assets (size measure) and the TR output slack (or inefficiency) at -0.4108. Similar results were observed with NOCF slack. This finding ties well with prior study which found out an existence of positive relationship between the size of Saccos and efficiency (Magali, 2014).

4.1. OLS Regression Correlation and Stochastic Frontier Analysis Results

The correlation between environmental factors (prime regressors) and specific predictor variables was tested for purpose of eliminating highly correlated prime regressor(s). The results indicated are mixed with only one significant variable of compliance with regulation having R^2 adjusted of 0.868 as shown in table VII. This lend to retention of all environmental predictor variables in the final model of this study. This study finding in table VIII also indicates that women on the board decrease results to increases in TR inefficiency although insignificant. The influence of macroeconomic variables to dependent variable of TR slack is also insignificant.

The Gamma of 0.999956 is not far away from one. Therefore, hypothesis H_{01} is rejected, H_{02} is also accepted while H_{03} is also accepted, all at 95% level of confidence. The result utilized 54 observations out of a total of 368 and indicates all predictors jointly influence inefficiency given Wald Chi sq. (20) =36.34 (p-value 0.014). However, the influence of control variables on TR slack variable is also insignificant. The mean of truncated-normal distribution (m_0) value of -289.902 is far from zero, thus a reflection of inability for study data to reduce to OLS regression Stata (2015).

Table-VII. Regress Predictors: CPI, GDP, GOKLB, INSP, & FLIB

Dependent Variables	Adj. R^2	Prob. > F	OBS. (95% Conf.Int.)
Age	0.04	0.0011	368
Ca	0.01	0.122	368
Ta	0.06	0.0001	368
Npta	0.012	0.097	368
Ao	-0.014	1.000	368
Lp	0.118	0.000	368
Mp	-0.0005	0.439	368
Clr	0.868	0.000	368
Atech	0.046	0.0005	368
W	-0.010	0.93	368
Ncfma	-0.006	0.699	368
Ms	0.065	0.000	368
Wc	-0.0005	0.441	368
Bond	-0.0000	0.419	368
Fi	0.0371	0.0022	368

Source: Researcher, (2015)

Table-VIII. Time Varying Inefficiency Model-Regression of Total Revenue Output Slack to Predictor Variables: with Control Variables

Observations =54				Wald chi	$\chi^2(20) =$	36.34
Log likelihood	53.1836			Prob > c	hi ² =	0.014*
Slack TR	Coef.	Std Err.	Z	P> z	[95% Conf. Interval]	
age	-0.09643	0.090336	-1.07	0.286	-0.27348	0.080628
ca	0.020402	0.037699	0.54	0.588	-0.05349	0.09429
ta	0.021491	0.028263	0.76	0.447	-0.0339	0.076886
npta	-0.26236	0.262064	-1	0.317	-0.77599	0.251278
ao	0.167405	0.086679	1.93	0.053**	-0.00248	0.337292
lp	0.000034	0.00191	0.02	0.986	-0.00371	0.003778
mp	0.013804	0.02036	0.68	0.498	-0.0261	0.05371
clr	-0.01868	0.24148	-0.08	0.938	-0.49197	0.454609
atech	0.00281	0.002263	1.24	0.214	-0.00162	0.007245
w	-0.08923	0.06838	-1.3	0.192	-0.22325	0.044795
ncfma	0.034894	0.088621	0.39	0.694	-0.1388	0.208588
ms	-0.02643	0.020443	-1.29	0.196	-0.06649	0.013641
cpi	0.014716	0.044597	0.33	0.741	-0.07269	0.102125
gdp	-0.01532	0.024155	-0.63	0.526	-0.06266	0.032021
goklb	0.005461	0.06479	0.08	0.933	-0.12153	0.132447
insp	0.678677	0.377107	1.8	0.072	-0.06044	1.417793
flib	-0.1093	0.090966	-1.2	0.23	-0.28759	0.068989
wc	0.062727	0.05055	1.24	0.215	-0.03635	0.161802
bond	0.026835	0.025506	1.05	0.293	-0.02316	0.076826
fi	-0.00476	0.005522	-0.86	0.388	-0.01559	0.006061
cons	-3.44586	1.88186	-1.83	0.067	-7.13424	0.242517
/mu	-289.902
/eta	-0.44029	0.154823	-2.84	0.004	-0.74374	-0.13685
/lnsigma ²	4.107683	0.011205	366.61	0.00	4.085723	4.129643
/ilgtgamma	10.02409	0.258082	38.84	0.00*	9.518262	10.52993
sigma ²	60.80566	0.681295			59.4849	62.15575
gamma	0.999956	1.14E-05			0.999927	0.999973
sigma u ²	60.80297	0.681299			59.46765	62.13829
sigma v ²	0.002695	0.000695			0.001333	0.004056

Source: Researcher, (2015). Significance levels: 1%*, 5%** and 10%***

5. Conclusion

The general objective of this study was to establish the determinants of technical inefficiency of deposit taking Saccos in Kenya, given a total revenue slack (an output inefficiency) as a dependent variable. To attain this objective, eight years' panel data for 46 Saccos was analyzed by the help of data envelopment analysis and stochastic frontier model using Stata14.1 software. Therefore, the effect of five macro-economic variables, thirteen specific Saccos' predictors and two control variables against dependent variable of TR slack were evaluated. The dependent variable slacks (inclusive of TR) were determined using data envelopment analysis model in Stata14.1. It was found that 13 out of 46 Saccos scored strong technical efficiency of 1 with an average technical inefficiency of 0.024 for the whole census of the study.

It was also found that specific variables do not influence Saccos' inefficiency given TR slack at 95% level of confidence. A unique result to this study is that the optimizer, ilgtgamma with significant p-value of 0.00 indicates how strong the Sacco operation is determined by management inefficiency, given TR with control variables.

Generally, this study indicates that the Saccos' specific variables given TR slack variable are not significant determinants of the technical inefficiency of Saccos in Kenya.

6. Contribution to Theory

This study conclusion is in line with x-inefficiency theory which states that inefficiency of decision making unit decreases as cost reduces, and banks' intermediation theory that postulates that banks' efficiency is positively

related to profitability. The study further supports the theory of inefficiency or x-inefficiency.

Further, it can be concluded that management influence is observed given TR slack with control variables presence as indicated by the level of Gamma. This lack of random error aspect signifies the high influence of management in Saccos, although the members' active participation may override the agency problem in management of Saccos' cash flows or resources.

6.1. Contribution to Practice and Recommendations

It can be concluded that the identification of strong Saccos' inefficiency or efficiency over different years can be used as benchmark. Those Saccos' unique features can be adopted as the best management practices. Further, another key contribution to practice is the evidence showing that TR slack with control variables is a key contributor in determining management inefficiencies as expressed by gamma factor. The study also concludes that large size Saccos exhibit less inefficiency characteristics and therefore the regulators should encourage merger of small or medium size Saccos in the economy. The efficiency benchmarking using DEA and stochastic mechanism are important in regulation.

6.2. Suggestions for Further Research

The identified limitation to this study is in the area of drilling down to specific efficient Saccos using a similar approach of study to find out at micro level what actually influences the individual inefficient or efficient Saccos in the sector. It is expected that this will invite more researches in this area as the inefficiency of Saccos over the two eras remained constant. Other reasons as to why TR slack is relevant in identifying management influence (agency problem) should further be researched beside the identification of the earnings management possibility. It may be essential to consider other predictors such as stock price real index, growth domestic product real index, income of individual members and the square of age. The comparative inefficiency study on non-deposit and deposit taking Saccos should also be studied in the future research.

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AP. I: Operational Definition of Terms

Common Bond Size: Number of entities through which Sacco members contribute funds (or share common interest) to the Sacco where they own shares and deposits (Researcher, 2015).

Cost Inefficiency: Saccos' excessive cost relative to the frontier. It is the difference between a benchmark and achieved performance i.e. x-efficiency (or proxy of agency costs) (Pagano *et al.*, 1997).

Credit and Savings Co-operatives: Saccos relying too much on external source of funds than share capital, reserves and member deposits (Researcher, 2015).

DEA: Data envelopment analysis

Earnings Management: In an organization when a governor fidgets with accounting numbers in order to report higher profits and subsequently pay high dividends is what is known as earnings management (Barth *et al.*, 2007).

Financial liberalization (FL): Measured by monetary aggregate (money supply or M3XT) to GDP (Cooper *et al.*, 2007)(Researcher, 2015).

GOK Net Lending/Borrowing as % of GDP (GOKLB): It measures the extent government is either putting financial resources at the disposal of other sectors in the economy (World Bank, 2014). This is a proxy for financial depth and innovative activities in Kenya.

Inefficiency (Management Inefficiency): The proportion by which the observed outcome or goal attainment fall short of optimum level. It is represented by one-sided error term (U_{ijt}), with a non-zero mean. U_{ijt} is normally assumed to be truncated-normal (Greene, 2012; Aigner *et al.*, 1977).

Inflation Consumer Price Index (CPI): Measures changes in prices of goods and services that households consume that affect the consumers' real purchasing power and their welfare in Kenya. CPI and GDP deflator are cross-correlated (Reis and Mankiw, 2001). A proxy for market condition.

Interest Spread (INSP): Average lending rate minus average borrowing rate. (World Bank – LNDP, 2014). A proxy for risk pricing in Kenya

Liberalization Period (LP): Era of economic reforms specifically 1980s-1990s and after (Researcher, 2015).

Money Supply (M3XT): M3XT is the currency in circulation measure in Kenya that is all-encompassing (Khainga, 2014).

Post-Liberalization: After amendment of Co-operatives Act, 2004 (Researcher, 2015).

Pre-Regulation Period: 2010 and before SASRA time-from 2007 (Researcher, 2015).

Regulation Period: During SASRA from 2011 and after - to 2014 (Researcher, 2015).

SASRA License: Saccos operating FOSA were required by Saccos Societies Regulation 2010 of the Sacco Societies Act, 2008 to have applied for license by 17 June 2011 (SSA, 2008).

Slack: Amount by which either an output or input fail to attain the optimal efficiency. It is an equivalent of inefficiency level (Cooper *et al.*, 2007).

Specific Predictor Variables: Independent study variables (variance regressors) that exclude the macro-economic independent variables (Researcher, 2015).

Stochastic Frontier Analysis (SFA): A parametric method that can test hypotheses and can accommodate single output with multiple inputs. It also uses maximum likelihood econometric estimation and decomposes the error term (e) into two components (Aigner *et al.*, 1977).

Technically Efficient: A firm operates on the frontier of the production technology (Coelli *et al.*, 1997).

Urban Areas: Town or Municipality area. The Urban Areas are separated from Cities according to Kenya Urban Areas and Cities Act, No.13 of 2011, revised in 2015 (Researcher, 2015).